



Fleetguard®



EMISSION
Solutions™

Retrofit Overview

Connecticut Diesel Emissions Control Technologies Forum

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History

- | | |
|-----------|--|
| Oct. 2000 | Cummins Inc. evaluates exhaust aftertreatment business case |
| Jun. 2001 | Cummins Inc. decides to enter exhaust aftertreatment business |
| Jul. 2001 | Incubate new business within Fleetguard due to synergies with Nelson, all engine makes capability |
| Jan. 2002 | Leadership team in place

Two key areas of focus: <ul style="list-style-type: none">- Retrofit technology onto existing fleets- Develop products for first fit applications, support of customer requirements and legislation |
| Jun. 2005 | Fleetguard Emission Solutions becomes part of Cummins Components Business |



Engine Business

Components Business



Filtration & Exhaust



Emission Solutions



Segments of Business

■ First-fit

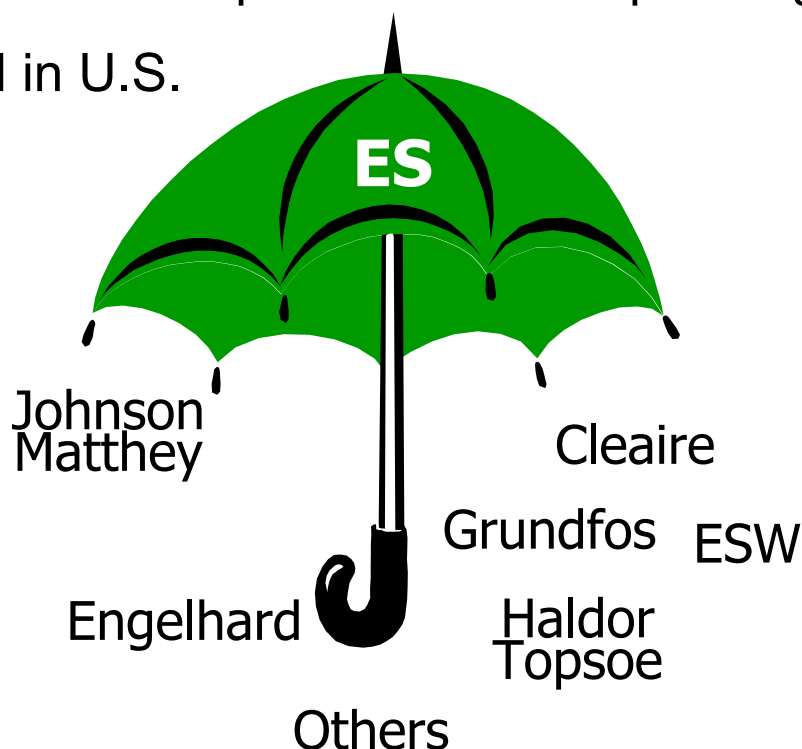
- Current first-fit market
- Buses, ITEC/Cummins Mid-Range, Pick-ups
- Future first-fit market
 - Euro IV, 2007, Euro V, 2010
 - All engine makes capability

■ Retrofit

- Urban bus, school bus
- Refuse
- Captive government fleets
- Private fleets – FedEx, Waste Management
- Stationary
- Off-highway - construction

FES Approach to Aftertreatment

- Offers a portfolio of emission control systems
- Based on best in class technology & cost for given emission control performance requirements and operating conditions
- Manufactured in U.S.



Retrofit

What is driving diesel retrofit?

- National Ambient Air Quality Standards
- Health Effects Issues
- Preserve Natural Resources
- Pristine Venues
- “Smoke and Smell”

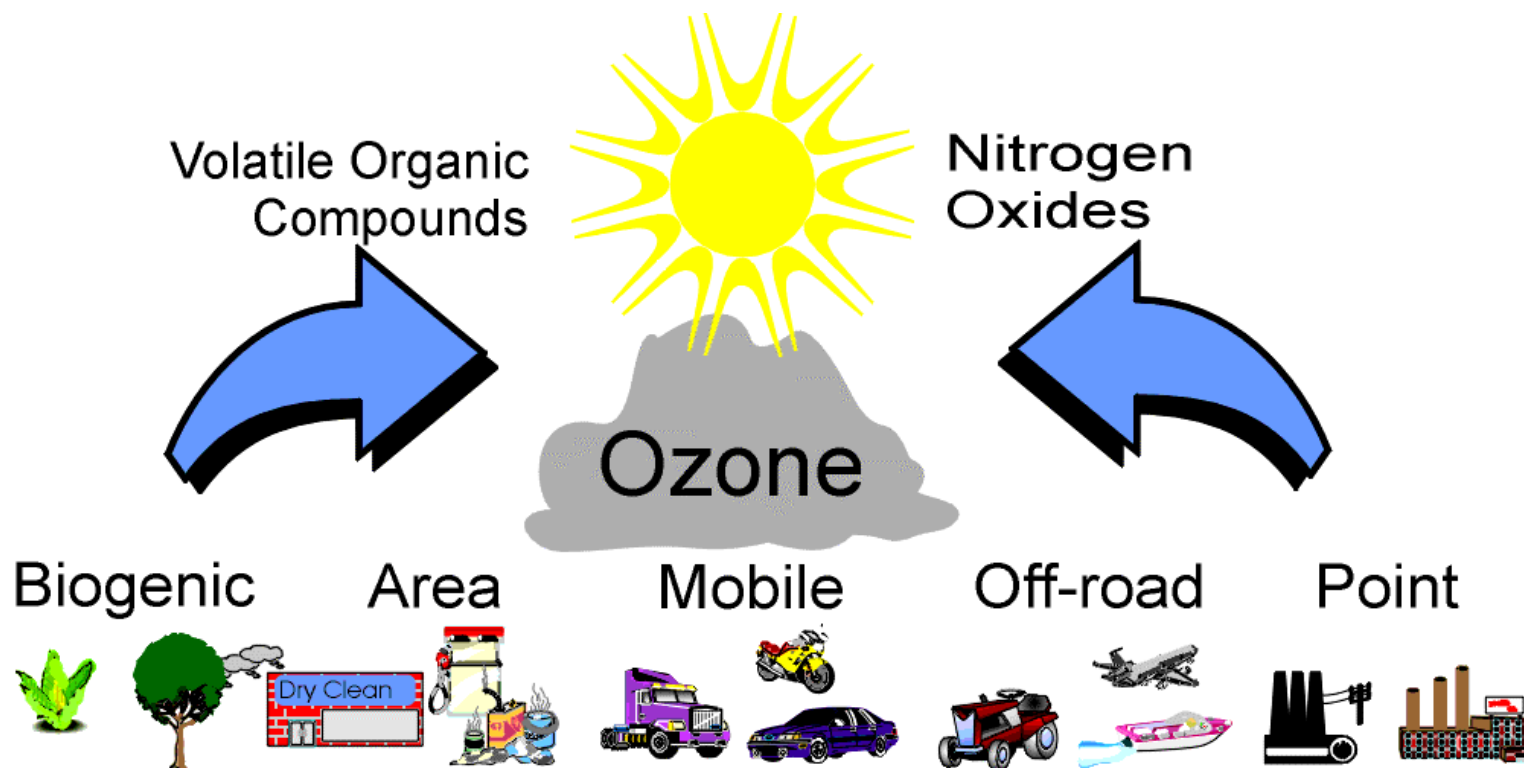
What we’ve learned?

- People generally want to clean up the air (retrofit)
- They don’t generally want to pay for the retrofit (funding)

Key regulated by-products

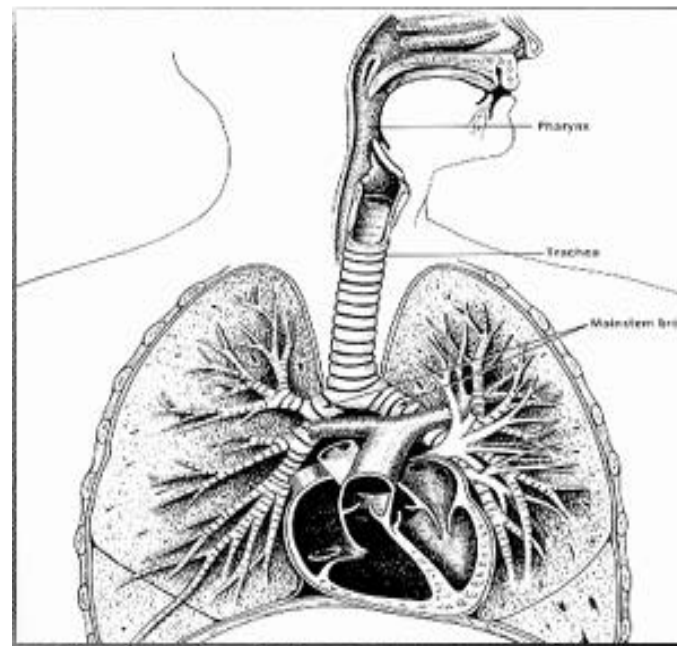
- Nitrogen Oxides – air quality / smog
- PM - health effects
 - 56% of PM emitted attributable to diesel
 - PM 2.5 is newest legislated – smaller particle
 - Black smoke
- HC / CO / Toxic Hydrocarbons - smell

Emission Basics - Ozone



Health Effects of Criteria Pollutants

- 95% of diesel particulate falls into PM 2.5
- Particles this size go deep into the lung
- Worsens preexisting respiratory conditions such as asthma and allergies

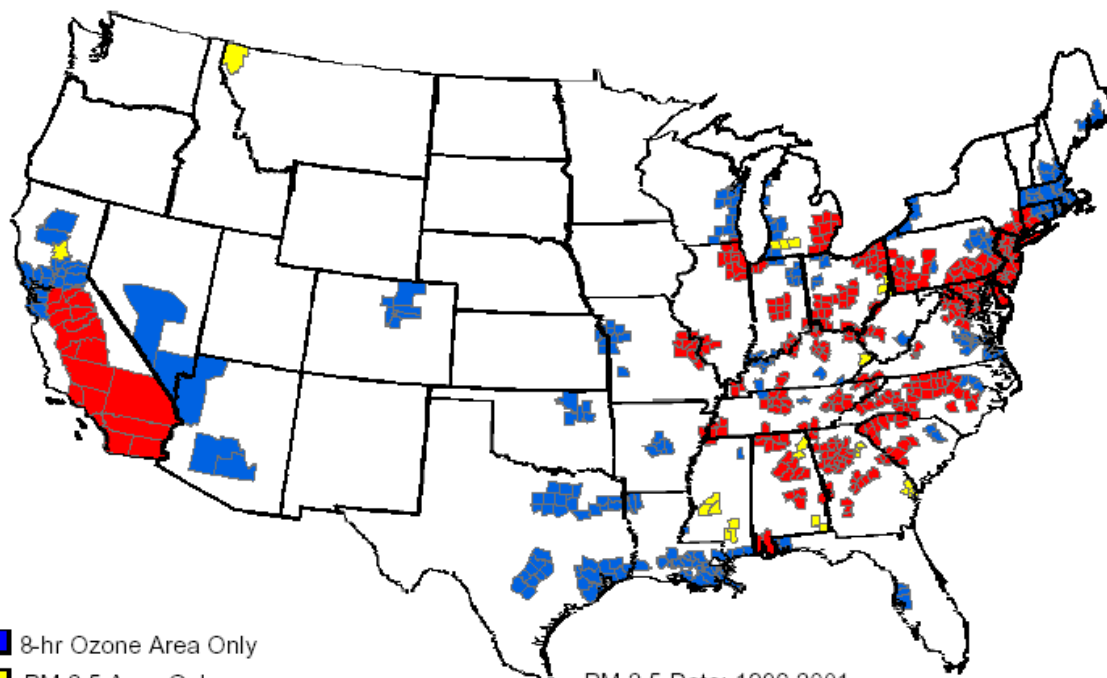


EPA Regions



Non-Attainment

Areas Not Meeting the 8-Hour Ozone or PM-2.5 Standards
CMSA Basis for Nonattainment Boundaries



- 8-hr Ozone Area Only
- PM-2.5 Area Only
- 8-hr Ozone and PM-2.5 Area

PM 2.5 Data: 1999-2001

Ozone data: 1998-2000 (primarily)

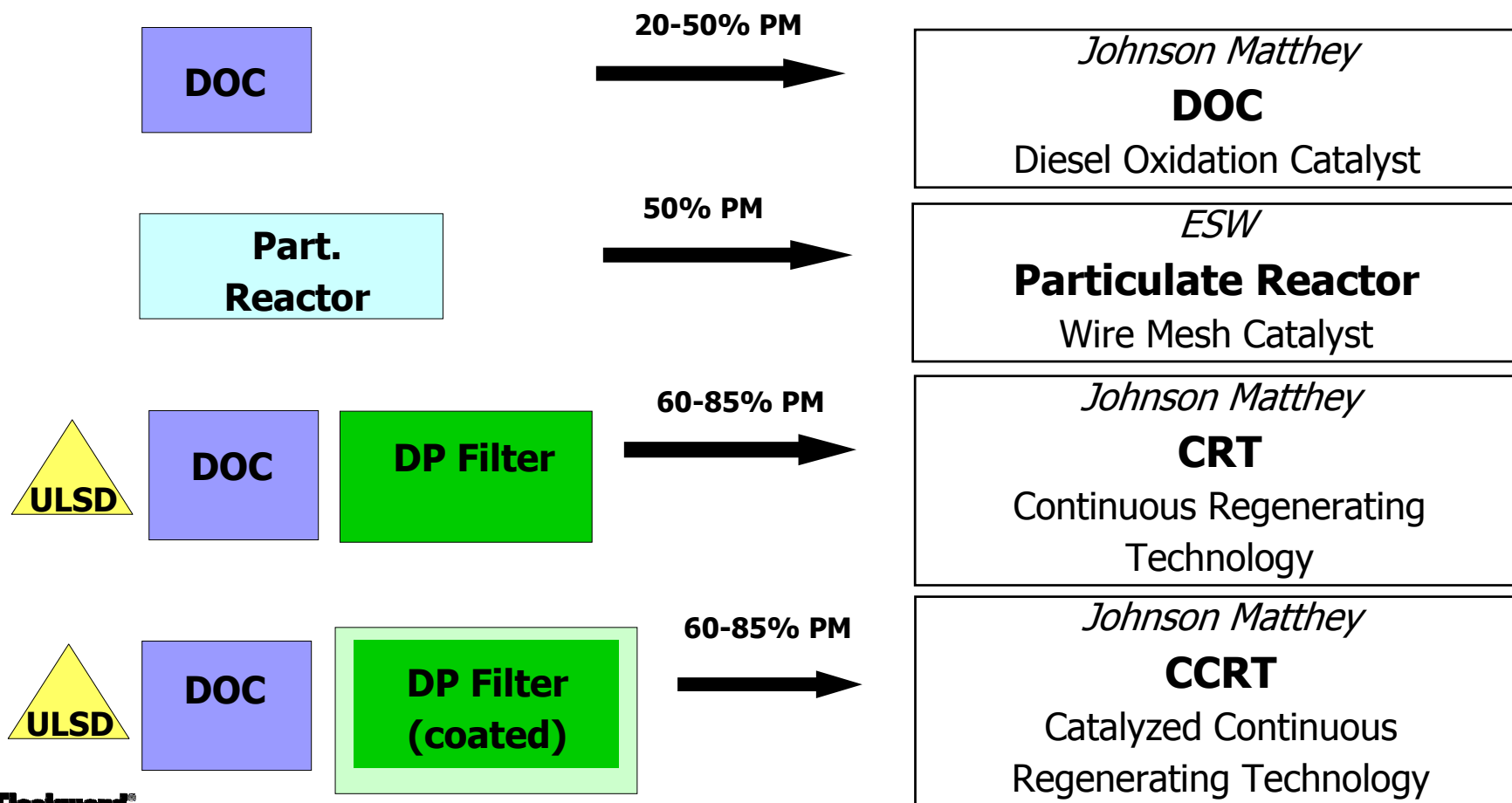
PM-2.5

Not Meeting Std: 131 counties, 65 million
Additional Counties in CMSA: 244 counties, 48 million
Total: 375 counties, 113 million

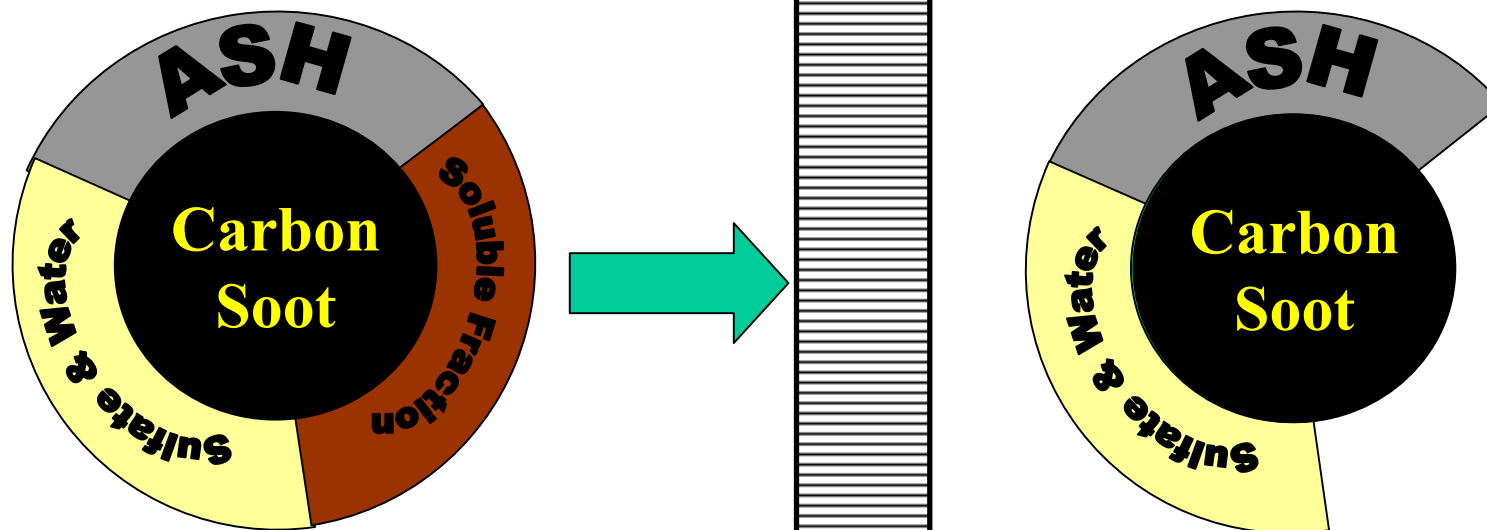
8-hour Ozone

Not Meeting Std: 341 counties, 124 million
Additional Counties in CMSA: 287 counties, 51 million
Total: 628 counties, 175 million

PM Reduction Technology Overview



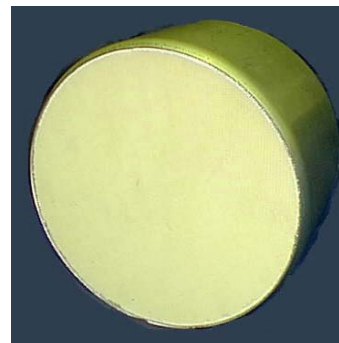
Diesel Oxidation Catalyst



- PM -- 20-50% Reduction
- CO and HC -- >90%
- Toxic HCs -- >70%

Diesel Oxidation Catalyst

- FES extensive experience (first fit and retrofit)
- Effective at removing unburned fuels and lube (soluble organic fraction)
- Compatible with ULSD and 500 PPM sulfur diesel fuels
- Ceramic substrate coated with Platinum
- Maintenance free, flow-through design
- EPA verification for Johnson Matthey (1991-2003)



How does a DOC work?

- Installed in place of a standard muffler
- Catalyst performs desired reduction in emissions
- PM -- 20-50% Reduction
- CO and HC -- >90%
- Toxic HCs -- >70%



Particulate Reactor

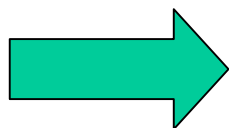
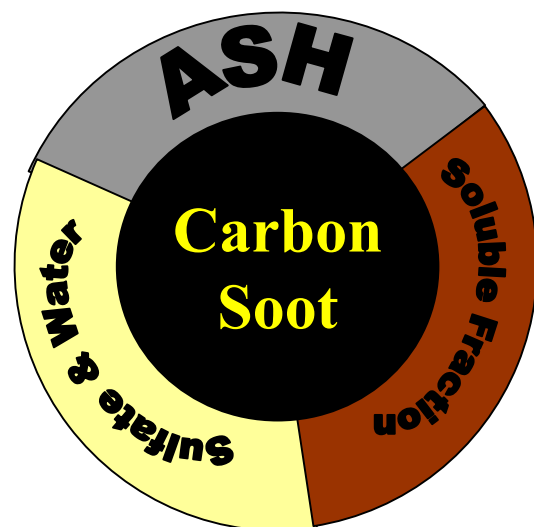
- CARB verified (1991-1993), Level 2
- 50% PM reduction
- Effective at removing unburned fuels and lube
- Compatible with ULSD and 500 PPM sulfur fuels
- Maintenance free
- Through flow design (tortured path)
- Application guidelines
 - Requires UCM monitor
 - 300 C at 16%
 - Sizing slightly larger than DOC



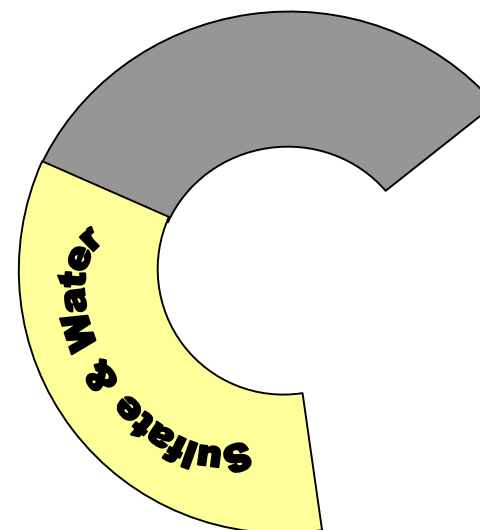
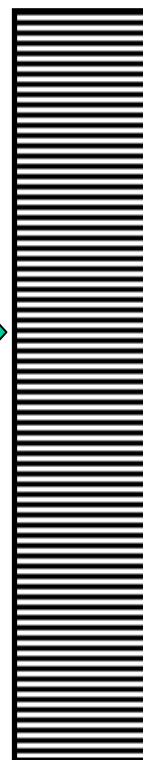
Particulate Reactor



Diesel Particulate Filter

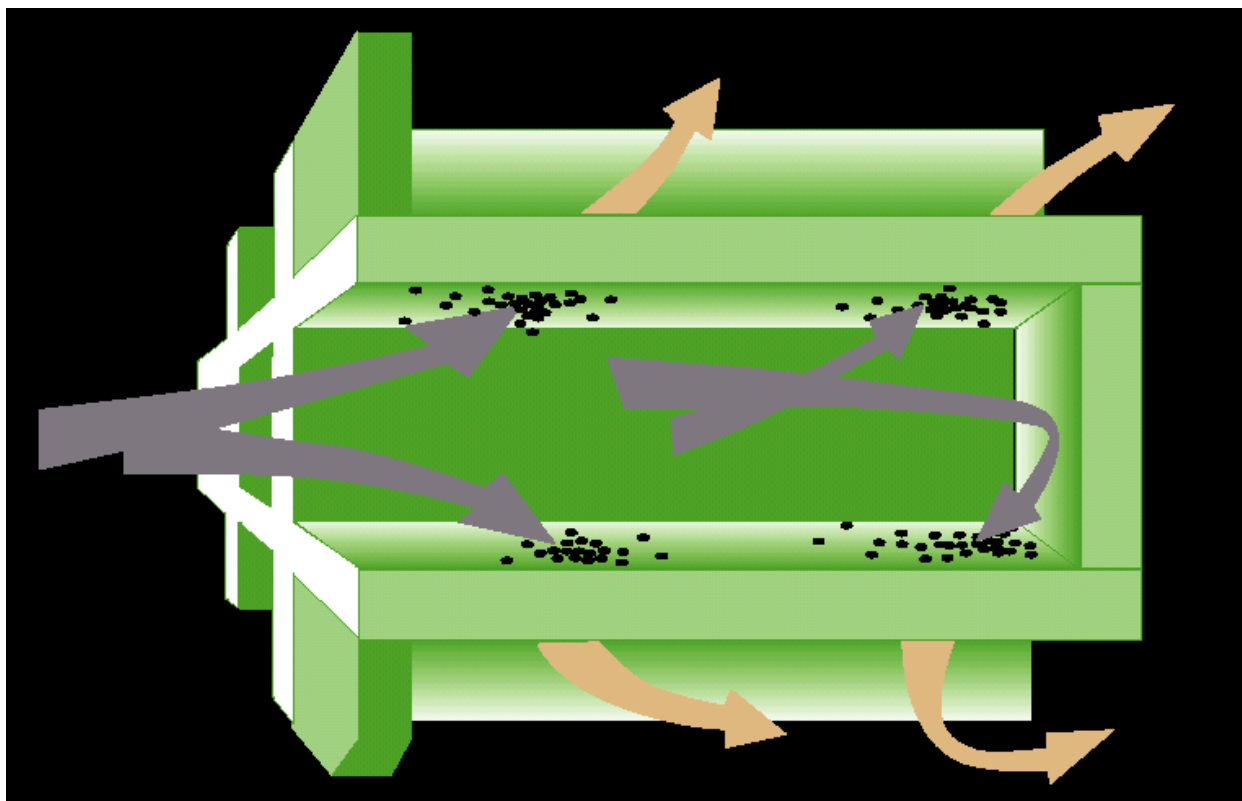


Filter



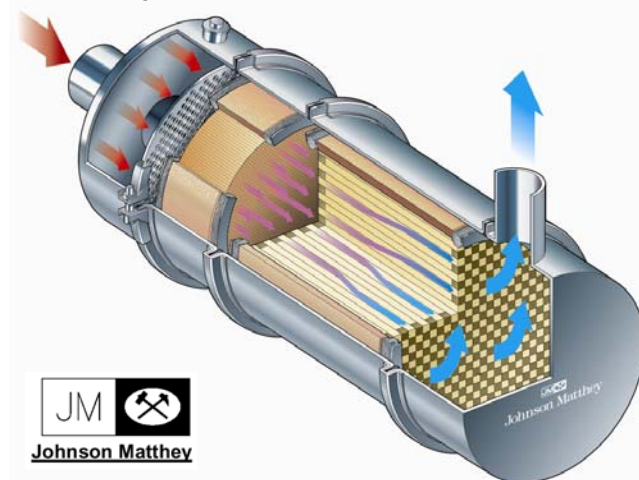
- PM > 85% Reduction
- CO and HC -- >80%
- Toxic HCs -- >80%

Wall Flow Design



CRT Particulate Filter

- Contains a Platinum (Pt) catalyst and a particulate filter
- ULSD required (50 ppm max.)
- Capable of converting > 85% of PM, HC and CO.
 - Exhaust temperature sensitive, application approval required
 - 240°C at 40%
- Passive system for retrofit
- CCRT version for lower temperature applications
 - 200°C at 40%
- Verified by EPA and CARB



CRT Particulate Filter



Outlet

Filter Section

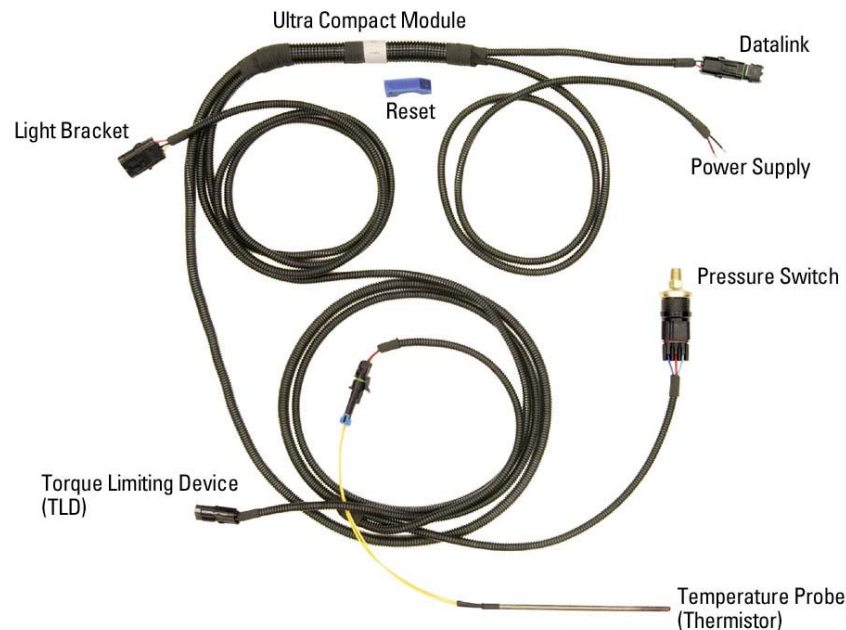
Catalyst Section

Inlet

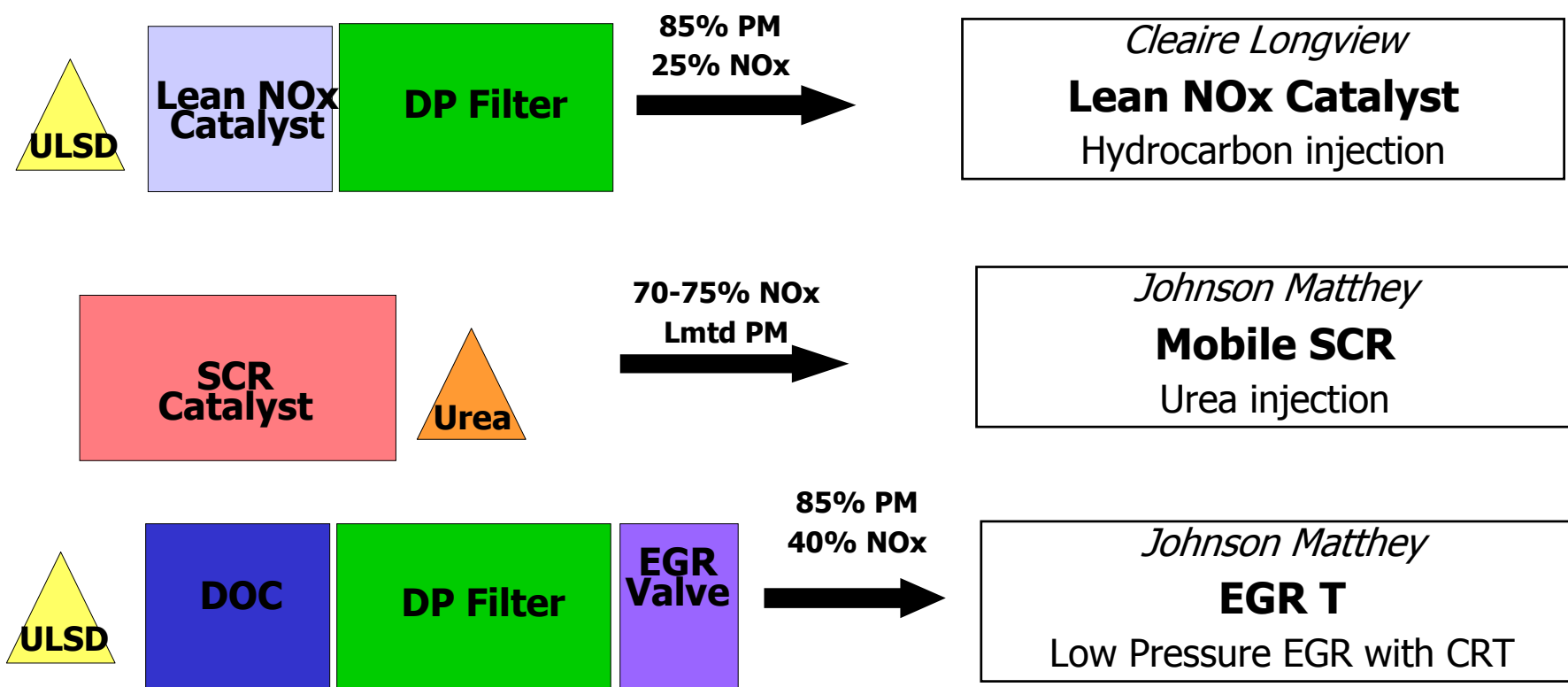
V-Clamps

Particulate Filter Monitor

- Monitors Pressure and Temperature of filter
- Maintenance alarm for the CRT
- Logs data for warranty / product development
- Reduces the following risks:
 - Plugging
 - Uncontrolled regeneration
 - Catalyst poisoning / deactivation
 - Engine progressive damage protection



NOx Reduction Technology Overview



Longview Install

Transit Bus Installation



Maintenance & Operation

Passive CRT & CCRT

- Require cleaning to remove ash
- Accumulated ash will increase back pressure on exhaust system (affects vehicle performance)
- Are modular for removable service
- Average retrofit cleaning cycle is 60k – 80k miles or once per year
- Derate strategy in addition to monitor can help
- No water intrusion
- ULSD required

Retrofit Maintenance



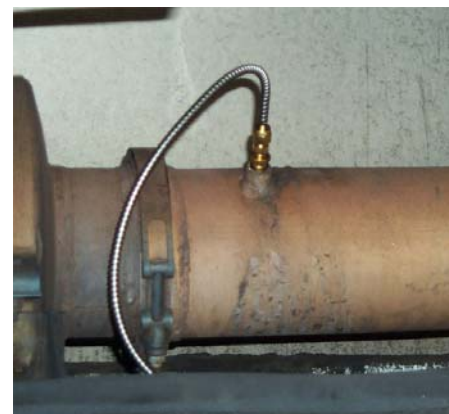
Maintenance & Operation

DOC

- No maintenance
- No lube oil blending
- No water intrusion

Datalogging

- Measures exhaust temperature over time
- Required for soot filter design
- Must use certified device and process



Crankcase Ventilation

– OCV/CCV

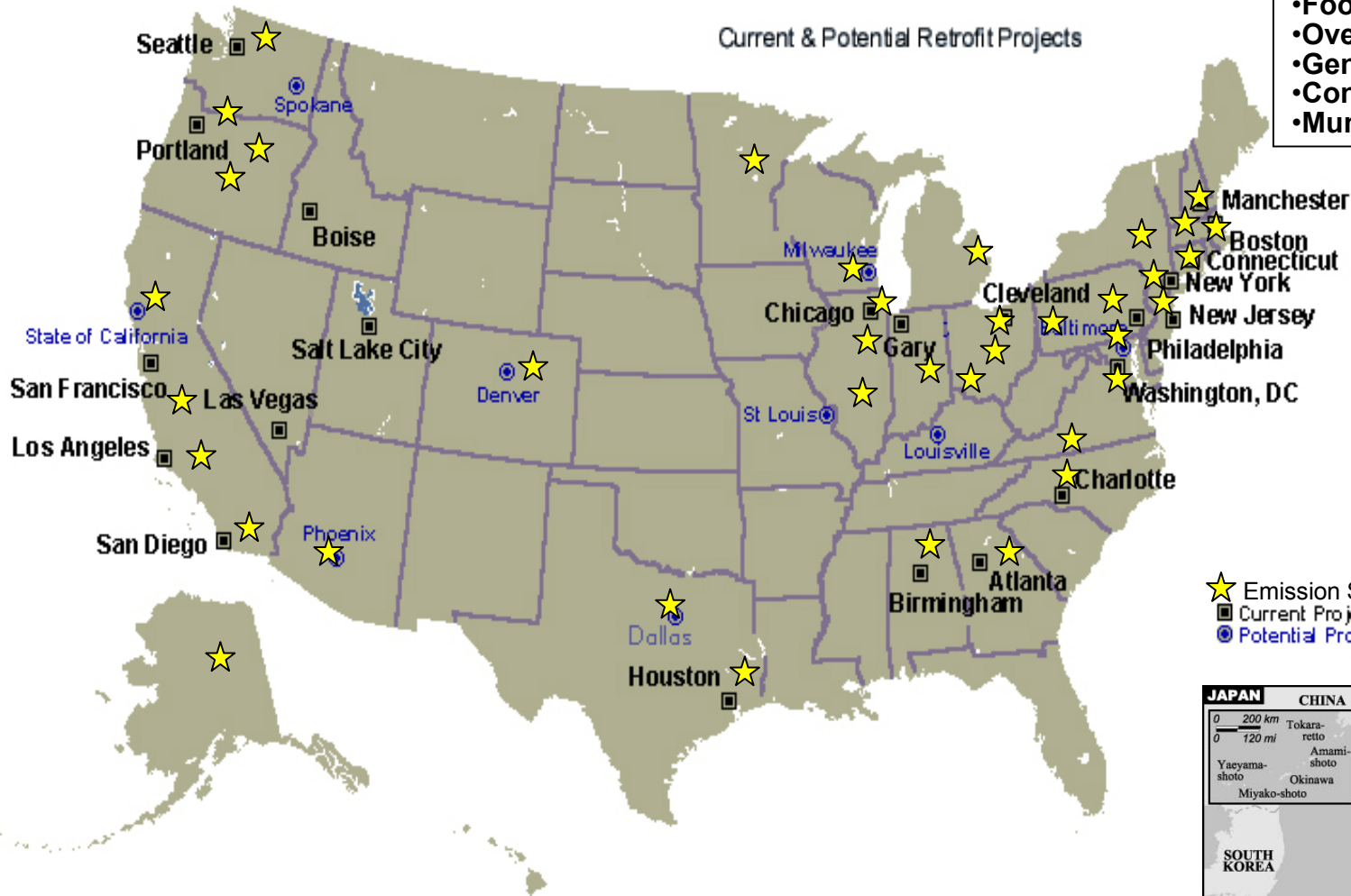
- OCV available today – Enviroguard™
 - Breather assembly
 - No maintenance
 - Over 400,000 in service
- CCV – Enviroguard™
 - In demonstration
 - Retrofit and first fit
- Verification with EPA in process
- 3-5% PM Reduction

Retrofit Installation & Support

- Manufactured in U.S.
- Global service & support network
- Installation consulting from local distributor
 - Rocky Hill, CT
 - Bronx, NY
 - Newark, NJ
- Trained, certified Cummins technicians, all-diesel makes
- Full product line (PM, NOx, PM + NOx)
- Verified by EPA, CARB

Retrofit Experience

- Bus (transit, school shuttle)
- Refuse Trucks
- Step Vans
- Food / Fuel Haulers
- Over the Road
- Generators
- Constructions Equipment
- Municipal Equipment



Contact Information

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